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(54) **DENTIFRICE-MEDICATION DISPENSING TOOTHBRUSH**

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EP 0 565 598 B1

**Description**Technical Field

5 This invention relates generally to dental hygiene devices and more specifically concerns a dentifrice/medication dispensing vibrating toothbrush.

Background Art

10 It is well-known that periodontal disease affects a significant portion of the population. It is also well-established that periodontal disease is primarily caused by complex aggregates of microorganisms, primarily bacteria, in the crevice regions between the teeth and the teeth and the gums. These aggregates are commonly referred to as dental plaque.

While brushing with conventional toothbrushes and flossing are currently the standard methods of removing, disrupting and dispersing dental plaque, such techniques have proven to be at best only partially effective, as indicated by 15 the widespread incidence of periodontal disease in the population.

U. S. Patent No. 4,787,847 is illustrative of a new development in toothbrushes which shows promise in reducing periodontal disease when used regularly. The device utilizes a transducer to produce vibrations in a brushhead, which results in mild cavitation being produced in the gingival (between teeth and gums) fluids in the mouth. This tends to remove the subgingival plaque and to demobilize motile bacteria therein.

20 However, the device relies on the presence of saliva and toothpaste foam as the medium through which the acoustical energy is conducted and in which cavitation occurs. For many users of the device, this may not be sufficient, especially for the upper teeth. There is no means included in the device for supplying fluid to assure an adequate medium.

In another line of development, medications are known which are capable of inhibiting or killing bacteria responsible for periodontal disease, and the use of such medications has been promoted to the public for such a purpose. Such 25 medications may be used in toothpaste, mouthwash, or solutions applied to the areas of interest. However, such medications are typically expensive when used on a daily basis, have been found to stain teeth in some cases with prolonged use, and in other cases, such as when they are in a mouthwash, are only marginally effective. Applying medication with brushing is convenient for the user and results in the treated area simultaneously undergoing cleaning and the application of medication. However, medication is typically not carefully applied in controlled amounts during 30 brushing. There currently is no convenient way of assuring the application of only therapeutic amounts, so as to prevent waste of the medication, while still being fully effective.

In still another independent line of development in dentistry relating specifically to toothbrushes and toothpaste, it is known to include structure for dispensing a dentifrice in an otherwise conventional toothbrush. In one approach, the toothbrush includes an attachment which dispenses toothpaste in some manner onto the tips of the bristles. Typically, 35 these devices include a reservoir for storing the dentifrice and a means for pumping out the dentifrice from the reservoir onto the tips of the bristles. Examples of this approach include U.S. Patent No. 4,787,765 and U.S. Patent No. 4,695,177, both to Kuo. In another approach, dentifrice is dispensed to the base of the toothbrush bristles. U.S. Patent No. 4,221,492 to Boscardin et al is an example of this approach, as is U.S. Patent No. 4,655,627 to Bradley, which also discloses a self-sealing reservoir.

40 U.S. Patent No. 4,039,261 to Evans shows a still further approach, involving hollow bristles, in which the dentifrice is moved into the bristles at the base thereof and then is moved through the bristles under pressure to the tips. However, the bristles are oversize and do not provide the typical brushing action for the teeth. Also, there is no provision of a cap or similar element to prevent leakage and/or drying of the dentifrice.

Additionally, U.S. Patent No. 3,547,110 discloses an oral hygienic unit comprising the features specified in the preamble of claim 1. In particular, it includes a reservoir 22 and a pump 20 for supplying fluid to an ultrasonic motor 18 and applicator 18. 45

The above-described dentifrice-dispensing toothbrushes and devices, however, have several disadvantages. They typically include complicated mechanisms for supplying the dentifrice to the brushes, resulting in inconvenient overall size of the toothbrush, high cost, and reliability problems. Those devices which use pastes have the additional problems 50 of clogging and the formation of hard, cake-like deposits, which prevent reliable flow of the paste when needed. None of these devices supply fluid at a controlled rate which is needed to assure a proper acoustical effect for a vibrating toothbrush, as described above. Further, the lack of fluid control makes such devices unsuitable for use as applicators of therapeutic (medication) agents.

Accordingly, the present invention is a toothbrush having a dentifrice-dispensing capability, comprising: 55

a toothbrush assembly including a toothbrush body, a brushhead, which includes bristles, in the vicinity of one end of the body, means for supporting said brushhead for vibrating movement, and means for driving said brushhead such that it vibrates, so that the toothbrush assembly is capable of producing a mechanical scrubbing of the teeth

as well as producing an acoustical cleaning effect for the teeth and surrounding areas; a reservoir for dentifrice; means defined in the brushhead permitting release of dentifrice from said brushhead; and means connecting said reservoir to said release means wherein the toothbrush is characterised in that said driving means is located in the toothbrush body and includes means for vibrating said brushhead at such a frequency and amplitude that dentifrice is drawn from said reservoir and out through said release means by the vibrating movement of the brushhead without the necessity of a separately located pump.

#### Brief Description of the Drawings

Figure 1 is a simple schematic diagram of one embodiment of the dentifrice-dispensing toothbrush of the present invention.

Figure 2 is a diagram showing the general electrical structure of a vibrating toothbrush.

Figure 3 is a cross-sectional diagram of the embodiment of Figure 1.

Figure 4 is a simple schematic diagram of another embodiment of the dentifrice-dispensing toothbrush of the present invention.

Figure 5 is a cross-sectional diagram of the embodiment of Figure 4.

Figure 6 is a cross-sectional diagram showing an alternative embodiment of one portion of the structure of Figure 5.

Figure 7 is a cross-sectional diagram showing one embodiment of the dentifrice reservoir portion of the toothbrush of the present invention.

Figure 8 is a cross-sectional diagram showing a variation of the reservoir embodiment of Figure 7.

#### Best Mode for Carrying Out the Invention

Figure 1 shows a simplified schematic diagram of one embodiment of the present invention, while Figure 2 shows the general electrical structure of an electromechanical vibrating toothbrush. The present invention is thus illustrated and described in the context of a particular toothbrush configuration, i.e. the vibrating toothbrush shown in Figure 2, but it should be understood that the present invention can be used in other toothbrushes in which the brushhead is vibrated in some manner.

Referring specifically to Figures 1 and 2, the vibrating toothbrush includes a body 12 which contains drive electronics 14 located in a handle portion 13 and a transducer 16, at the far end of which is positioned a brushhead 18, which extends out from the toothbrush body 12. The brushhead 18 is mounted for vibrating, i.e. up/down or side to side, movement relative to the body 12. The drive electronics 14 comprises basically a DC power supply 20, an oscillator 22, an amplifier 24 and a transformer 26. The output of the transformer acts on a piezoelectric bimorph transducer to produce the movement of the brushhead. The toothbrush structure shown generally in Figure 2 is explained in more detail in U.S. Patent No. 4,787,847, which is referred to briefly above.

Figure 1 shows, in the body 12 of the toothbrush, a dentifrice reservoir 30 located in handle portion 13, and a connecting tube element 32 which provides fluid communication between reservoir 30 and brushhead 18. Figure 3 shows the embodiment of Figure 1 in more detail. A section of body 12 is shown, as well as the brushhead 18, which is supported within an opening at the end of the body 12 by an isolating membrane 38. Within the brushhead 18 is a channel 42 and a small chamber 43. A tube 44 is connected to channel 42 in the brushhead 18 and extends in body 12 toward handle 13. Tube 44 connects with one end of a bell-shaped casing 46, which has an internal chamber 48. At the other end of casing 46 is a membrane 52. Extending from chamber 48 through membrane 52 and outwardly therefrom is a narrow tube 54 which extends into a cap 53 at the front end of the dentifrice reservoir 30. Such an arrangement permits replacement of the reservoir 30 without introducing air into the other portions of the dentifrice delivery system.

The reservoir 30 is preferably made in the form of a collapsible membrane in order to allow fluid to move from the reservoir without creating a vacuum therein. The collapsible membrane reservoir 30 could, for instance, be a thin wall heat-sealed pouch of vinyl or polyurethane with a tube or rubber o-ring seal. Such a reservoir can be filled, sealed and supplied in a foil wrapped outer pouch to protect any solvents, e.g. alcohol, or oxygen for a gas-releasing dentifrice. The user will remove the membrane reservoir from its outer pouch, attach it to the casing 46 and then prime the system by pushing in on the membrane until dentifrice appears at the bristles. As an alternative to a collapsible membrane, the reservoir 30 could include an air vent.

An alternate embodiment for the reservoir is shown in Figure 7. In this embodiment, reservoir 37 is positioned within the body of the toothbrush, typically in the handle portion thereof (not shown). The reservoir 37 could also be located within a removable head assembly attached to the body of the toothbrush. The reservoir 37 includes a door 39 which, in one embodiment, could be a thumb-activated sliding door. A spring 41 biases the door 39 to its closed position. The door is not air tight, to provide a vent for the reservoir, but does prevent the dentifrice fluid from leaking out. A tube 43 connects the reservoir 37 to a feed tube 45 which is connected to the vibrating brushhead.

The reservoir 37 could also include a wick element 47, such as a polypropylene felt, which extends between the

reservoir 37 and the feed tube 45 in order to prevent air bubbles in the reservoir from moving into the feed tube, thereby maintaining a continuous stream of fluid between the reservoir and the feed tube.

Alternatively, referring to Figure 8, a flexible tube 49 with a weight 51 could be included in reservoir 37. The flexible tube is connected to or is an extension of connecting tube 43. The weight 51 is positioned near the free open end 55 of flexible tube 49, such that gravity would tend to hold the free open end of tube 49 in any fluid in reservoir 37, regardless of the orientation of the toothbrush and hence the reservoir.

In addition, a sponge member could be placed in the reservoir 37. The sponge comprises a material which is able to store fluid, such as water or a medicine. The sponge will release the fluid as fluid is drawn out of the feed tube.

Referring now again to Figure 3, a plurality of bristles 56 extend from one surface of the brushhead 34 and are in fluid communication with chamber 43 in the brushhead. A selected number of the bristles are hollow, to permit the correct amount of dentifrice to be dispensed. This arrangement permits the dentifrice to move from the reservoir through the tube 54, the casing 46, the tube 44 and then into the channel 42, the chamber 43, and then through the hollow bristles to the ends thereof, such that in use of the device, the dentifrice is applied to the actual area of interest.

Figures 4, 5 and 6 show another embodiment of the present invention and a further variation of a portion of that embodiment. Figure 4 is a simple schematic view of a vibrating toothbrush which includes a body portion 60 which has a brushhead 62 extending therefrom at one end 64 thereof. The brushhead 62 is mounted and driven for vibratory (i.e. up/down or side to side) action by a drive mechanism such as that described above with respect to the embodiment of Figures 1 and 3 and the structure shown in U.S. Patent No. 4,787,847. Referring to Figure 4, the brushhead 62 itself contains the dentifrice reservoir. When the dentifrice is depleted, the old brushhead is removed from the driving mechanism and a new one inserted. Figure 5 shows the brushhead portion of the body 60 of Figure 4, in which is mounted a supporting membrane 68. The drive plunger 70 is driven by a transducer (not shown) and includes at one end thereof a threaded portion 72 to which may be conveniently removably secured a brushhead 62.

The brushhead 62 includes an interior chamber 74 in which is positioned the fluid reservoir 76 containing the dentifrice. The reservoir 76 comprises a collapsible membrane, so that atmospheric pressure, which is introduced through a pressure relief opening 78 in the brushhead 62, collapses the reservoir 76 as fluid is delivered therefrom. This prevents a vacuum from forming in the reservoir which would impede the flow of dentifrice therefrom. The reservoir 76 is in fluid communication with a plurality of hollow bristles 80 which extend from one side of the brushhead 62. Again, the number of hollow bristles is selected so that the desired amount of dentifrice is dispensed. In operation, the dentifrice is delivered from the reservoir through the hollow bristles to the tips thereof, where it is applied to the area of interest, as the bristles are brought into contact with the teeth and gums.

Figure 6 shows a variation of the brushhead arrangement of Figures 4 and 5, which can also be used in the brushhead of Figure 1 and 3. Instead of hollow bristles, the bristles 84 are solid, with the area 86 of the brushhead from which the bristles 84 extend including one or more nozzle-like openings 87 therein, which are either in fluid communication with the fluid reservoir 88 in the brushhead (similar to reservoir 76 in Figures 4 and 5) or an internal chamber in the brushhead, like chamber 43 in Figure 3, which contains dentifrice delivered from a remote reservoir.

Dentifrice is supplied to the area of interest by the action of the toothbrush in two ways. One way is through capillary action. Either with the hollow bristle embodiment or with a brush having tufts of solid bristles, as fluid is removed from the vicinity of the brushhead in the use of the device, capillary action draws fluid from the reservoir to replenish what has been used. The more fluid used, the more is replaced. This is true "demand feed" action. Capillary action has been demonstrated over a frequency range of 100-300 Hz. A frequency of 140 Hz for the vibrating toothbrush provides very effective results. It has been found that the supply of fluid when the toothbrush is under a heavy load is nearly twice that when the toothbrush is unloaded. Again, the capillary feed action is due to the use of hollow bristles or by locating solid bristles sufficiently proximate to each other that capillary action occurs.

The other way dentifrice is delivered is through the action of centrifugal force. Centrifugal force produced by the reciprocating vibration of the brushhead acts to force the dentifrice through the hollow bristles or through the nozzles in the brushhead to the vicinity of the tips of the bristles. In both instances, the surface tension properties of the dentifrice and the chambers are such that the dentifrice is retained behind the nozzle or the hollow bristles when the toothbrush is not vibrating, but when the toothbrush is vibrating, sufficient centrifugal force is produced to force the dentifrice out from the nozzles or the bristles. The rate of dispersion of the dentifrice is controlled by the amount of vibration energy of the brushhead, the size of the openings of the nozzles or in the bristles, and the number thereof, as well as the viscosity of the dentifrice.

For a sinusoidal motion of the tip of the bristles of the brushhead, having an amplitude  $X(t) = X_0 \sin \omega t$ , the resulting centrifugal force on an incremental radial section  $\Delta r$  will be  $F \Delta r = A d X_0^2 \omega^2 r \Delta r / G r_0^2$  where A is the area of the fluid column, d is the density of the dentifrice,  $X_0$  is the amplitude of the motion of the bristles,  $\omega$  is the frequency of oscillation, r is the distance from the center of the motion,  $\Delta r$  is the radial thickness of the section, and G equals the gravitational acceleration. The factor G is included so that the force will be expressed in grams. For a column of fluid distributed from  $r=0$  to  $r=r_0$ , the resulting centrifugal force  $F_c$  is:

$$F_c = A d X_0^2 \omega^2 / G r_0^2 \int_0^{r_0} r dr = A d X_0^2 \omega^2 / 2G.$$

5 In a specific example, where  $r_0 = 2.5\text{cm}$  (1.0 inches),  $f = 200\text{ Hz}$  (for water)  $= 1.04\text{g/cm}^3$  ( $16.3\text{g/inch}^3$ )  $X_0 = 25\text{mm}$  (0.10 inches), and a tube diameter of  $25\text{mm}$  (0.10 inches), the resulting force  $F_c = 2.7$  grams.

This centrifugal force of almost 20 times that of the force of gravity on the same volume of fluid ( $0.008\text{ inch}^3$ ) is sufficient to force a fluid through a nozzle or hollow bristle when the brushhead is vibrating, but no drop will move through the nozzle or bristle when the vibration is not present. The centrifugal force is so much stronger than gravity that the fluid delivery performance of the toothbrush is relatively independent of position.

The rate at which fluid is dispensed is controlled by the dimensions of the dispensing mechanism and the choice of fluid. This includes the size of the exit orifice for the fluid, the fluid pressure and the viscosity of the fluid. The fluid pressure is determined by centrifugal force considerations discussed above. It has been determined by the inventors that rate control under loads of  $\pm 15\text{-}20\%$  are practical.

15 While the dentifrice dispensed by the toothbrush of the present invention may be any one of a number of solutions, including a bacterial agent such as an antibiotic like chlorhexidine to control infection, other medications for various treatment and/or preventative purposes may be used, as well as a cleansing or foaming agent, or even water, which will aid the action of the energy of the vibrating toothbrush. The dosage of therapeutic solutions can be carefully controlled and administered, simultaneously with the accomplishment of conventional oral hygiene. This can minimize stain buildup. Correct dosages will minimize systemic absorption of the medication. All of these types of solutions and others are included under the general term dentifrice. Preferably, the dentifrice is a fluid.

The medication or dentifrice to be used in the present invention can initially be in the form of a solid pellet, either in a porous bag or in a package form. The dentifrice/medication will be placed in the reservoir along with tap water in which the dentifrice will dissolve. The rate of dissolution can be controlled so that several separate applications may be made with a single pellet or the like.

In operation of the toothbrush of the present invention, power is supplied to commence vibration of the brushhead and hence the bristles thereon. This action of the bristles can be used to mechanically "scrub" the teeth to remove food particles and disrupt plaque reachable with the bristles. The user typically will concentrate on the sulcus and interdental regions of the teeth.

The vibrating action of the brushhead also at the same time provides acoustical energy sufficient to support cavitation and streaming throughout the entire mouth area, including areas beyond the reach of the bristle contact. The dentifrice-dispensing feature of the present invention assures effective cavitation and streaming throughout the entire dental area with its active supply of fluid. The acoustical cleaning effect is thus more effective than that which would result by reliance on saliva and toothpaste alone.

The present device thus combines the benefits of scrubbing bristles with controlled cavitation and streaming, accomplished by the combination of a source of vibration for a brushhead, an appropriate brushhead design and means for supplying fluid at a controlled rate to the brushhead. It should also be noted that the disclosed fluid dispensing mechanism results in the bristles being continuously wet, but not excessively so, which would result in splattering when the device is not in the mouth or in causing the user to remove excess fluid by swallowing, etc., when the device is in actual use. Fluid is supplied basically on demand, to the extent actually needed to maintain effective cavitation and streaming.

A further important advantage of the present invention occurs when the dentifrice is a medicine or chemical agent such as an antibacterial agent, i.e. chlorhexidine. Application of the sonic energy to a medicinal cavitation fluid enhances the effect of the medicinal or chemical agent, thus resulting in a synergistic effect between the acoustical energy of the toothbrush and the medicine or chemical agent. Although it is known generally that acoustic energy can intensify the effect of antibacterial and other chemical agents, the use of acoustic energy delivered by a toothbrush with concurrent delivery of a medicinal agent to provide an enhanced cleansing/medicinal effect for teeth is not believed to be known.

Thus, a new dentifrice-dispensing toothbrush has been disclosed which delivers the dentifrice reliably to an area of interest by virtue of the vibrating action of the toothbrush. This toothbrush permits a careful, accurate targeting of a particular location for application of a dentifrice medication.

The apparatus of the present invention is capable of using the vibration driving source to supply the fluid to the bristles, without the need for a separate pump. Medication can be automatically applied in precisely controlled amounts during brushing, without the direct intervention of the operator.

Although a preferred embodiment of the invention has been disclosed herein for illustration, it should be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the invention as defined by the claims which follow:

Claims

1. A toothbrush having a dentifrice-dispensing capability, comprising:

a toothbrush assembly including a toothbrush body (12), a brushhead (18), which includes bristles (56), in the vicinity of one end of the body, means for supporting said brushhead for vibrating movement, and means for driving (14) said brushhead such that it vibrates, so that the toothbrush assembly is capable of producing a mechanical scrubbing of the teeth as well as producing an acoustical cleaning effect for the teeth and surrounding areas; a reservoir for dentifrice (30); means defined in the brushhead (18) permitting release (43, 18, 87) of dentifrice from said brushhead; and means (42,44) connecting said reservoir (30) to said release means (43,18,87) wherein the toothbrush is characterised in that said driving means (14) is located in the toothbrush body (12) and includes means for vibrating said brushhead at such a frequency and amplitude that dentifrice is drawn from said reservoir and out through said release means by the vibrating movement of the brushhead without the necessity of a separately located pump.

2. A toothbrush according to Claim 1, characterised in that the frequency of vibration of the brushhead is within a range of 100-300Hz.

3. A toothbrush according to Claim 1 or 2, characterised in that said brushhead (18) includes a small chamber (43) therein which is in fluid communication with said release means (43,18,87) and wherein said connecting means includes means connecting said reservoir with said small chamber and said brushhead.

4. A toothbrush according to any preceding claim characterised in that said brushhead is arranged to be driven at a frequency and amplitude sufficient that acoustic energy is supplied to the dentifrice within the brushhead, which facilitates cavitation of the dentifrice when the dentifrice exits from the release means.

5. A toothbrush according to Claim 2, wherein at least some of said bristles (56) are hollow and are in fluid communication with said connecting means and hence said reservoir, said hollow bristles thereby defining said release means.

6. A toothbrush according to Claim 2, wherein said release means comprises nozzle-like openings (87) in said brushhead, wherein said bristles (84) are solid and arranged in tufts and wherein said nozzle-like openings (87) are in fluid communication with said connecting means and hence said reservoir.

7. A toothbrush according to Claim 5, wherein the source of acoustic energy (14,16) is capable of vibrating the brushhead at such a frequency and amplitude that fluid is discharged from the bristles at least partially by capillary action.

8. A toothbrush according to Claim 5, wherein the size of the hollow openings in the bristles is such and wherein the source of acoustic energy (14,16) is capable of vibrating the brushhead at such a frequency and amplitude that fluid is discharged from the bristles at least partially by centrifugal force.

9. A toothbrush according to Claim 6, wherein the bristles are positioned on the brushhead relative to each other in such a manner and wherein the source of energy (14,16) is capable of vibrating the brushhead at such a frequency and amplitude that fluid is discharged from the openings at least partially by capillary action.

10. A toothbrush according to Claim 6, wherein the size of the openings is such and wherein the source of acoustic energy (14,16) is capable of vibrating the brushhead at such a frequency and amplitude that fluid is discharged from the openings at least partially by centrifugal force.

11. A toothbrush according to Claim 1, wherein the fluid includes a medicinal agent, and wherein the amplitude and frequency of vibration of the brushhead are sufficient to produce acoustic energy in the vicinity of the brushhead sufficient to enhance the effect of the medicinal agent at the teeth.

12. A toothbrush according to Claim 11, wherein said bristles have a hollow opening longitudinally therethrough, said hollow bristles being in fluid communication with the reservoir containing said medicinal agent.

13. An apparatus of Claim 11, wherein release means includes openings in said brushhead in the vicinity of the bristles

which extend therefrom, said openings being in fluid communication with the reservoir containing said medicinal agent.

# Patentansprüche

5

1. Zahnbürste mit einer Möglichkeit zur Abgabe von Zahnpaste, mit:

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einer Zahnbürstenanordnung mit einem Zahnbürstenkörper (12), einem Bürstenkopf (18) mit Borsten (56) in der Nähe des einen Ende des Körpers, einer Einrichtung zum Halten des Bürstenkopfes im Hinblick auf Vibrationsbewegungen und einer Einrichtung zum Antreiben (14) des Bürstenkopfes so, daß dieser vibriert, so daß die Zahnbürstenanordnung in der Lage ist, die Zähne mechanisch zu bürsten sowie einen akustischen Reinigungseffekt für die Zähne und die umgebenden Bereiche zu bewirken, einem Reservoir (30) für Zahnpaste, einer im Bürstenkopf (18) ausgebildeten Einrichtung für die Abgabe (43, 18, 87) von Zahnpaste aus dem Bürstenkopf und einer Einrichtung (42, 44) zur Verbindung des Reservoirs (30) mit der Abgabeeinrichtung (43, 18, 87), wobei die Zahnbürste dadurch charakterisiert ist, daß die Antriebseinrichtung (14) im Zahnbürstenkörper (12) vorgesehen ist und Einrichtungen zum Vibrieren des Bürstenkopfes bei einer solchen Frequenz und Amplitude aufweist, daß dem Reservoir Zahnpaste entnommen und aufgrund der Vibrationsbewegung des Bürstenkopfes durch die Abgabeeinrichtung hindurch ohne die Notwendigkeit einer getrennt vorgesehenen Pumpe abgegeben wird.

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2. Zahnbürste nach Anspruch 1, dadurch gekennzeichnet, daß die Vibrationsfrequenz des Bürstenkopfes im Bereich von 100 - 300 Hz liegt.

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3. Zahnbürste nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Bürstenkopf (18) eine kleine Kammer (43) aufweist, die mit der Abgabeeinrichtung (43, 18, 87) in Fluidverbindung steht, wobei die Verbindungseinrichtung eine Einrichtung umfaßt, die das Reservoir mit der kleinen Kammer und dem Bürstenkopf verbindet.

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4. Zahnbürste nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß der Bürstenkopf dazu ausgelegt ist, daß er bei einer Frequenz und Amplitude betrieben wird, die ausreicht, um die Zahnpaste im Bürstenkopf mit akustischer Energie zu beaufschlagen, was die Kavitation der Zahnpaste bei ihrem Austreten aus der Abgabeeinrichtung fördert.

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5. Zahnbürste nach Anspruch 2, bei der zumindest einige der Borsten (56) hohl sind und mit der Verbindungseinrichtung und daher mit dem Reservoir in Fluidverbindung stehen, wodurch die hohlen Borsten die Abgabeeinrichtung bilden.

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6. Zahnbürste nach Anspruch 2, bei der die Abgabeeinrichtung düsenartige Öffnungen (87) in dem Bürstenkopf aufweist, die Borsten (84) kompakt ausgebildet und büschelartig angeordnet sind, und die düsenartigen Öffnungen (87) mit der Verbindungseinrichtung und damit dem Reservoir in Fluidverbindung stehen.

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7. Zahnbürste nach Anspruch 5, bei der die Quelle der akustischen Energie (14, 16) in der Lage ist, den Bürstenkopf bei einer solchen Frequenz und Amplitude zu vibrieren, daß aus den Borsten zumindest teilweise aufgrund der kapillaren Wirkung Fluid abgegeben wird.

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8. Zahnbürste nach Anspruch 5, bei der die Größe der Hohlraumöffnungen in den Borsten so gestaltet und die Quelle der akustischen Energie (14, 16) in der Lage ist, den Bürstenkopf bei einer solchen Frequenz und Amplitude zu vibrieren, daß aus den Öffnungen zumindest teilweise aufgrund der kapillaren Wirkung Fluid abgegeben wird.

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9. Zahnbürste nach Anspruch 6, bei der die Borsten auf dem Bürstenkopf in bezug zu einander so angeordnet sind und die Energiequelle (14, 16) in der Lage ist, den Bürstenkopf bei einer Frequenz und Amplitude zu vibrieren, daß aus den Öffnungen zumindest teilweise aufgrund der kapillaren Wirkung Fluid abgegeben wird.

10. Zahnbürste nach Anspruch 6, bei der die Größe der Öffnungen so gestaltet ist, und die Quelle der akustischen Energie (14, 16) in der Lage ist, den Bürstenkopf bei einer Frequenz und Amplitude zu vibrieren, daß aus den Öffnungen teilweise aufgrund der Zentrifugalkraft Fluid abgegeben wird.

11. Zahnbürste nach Anspruch 1, bei der das Fluid einen medizinischen Wirkstoff enthält und die Amplitude und Vibrationsfrequenz des Bürstenkopfes ausreichend sind, um in der Nähe des Bürstenkopfes akustische Energie zu



erzeugen, die ausreicht, um den Effekt des medizinischen Wirkstoffes an den Zähnen zu verstärken.

12. Zahnbürste nach Anspruch 11, bei der die Borsten eine sich in Längsrichtung durch sie hindurch erstreckende hohle Öffnung aufweisen und die hohlen Borsten mit dem den medizinischen Wirkstoff enthaltenden Reservoir in Fluidverbindung stehen.

13. Vorrichtung nach Anspruch 11, bei der die Abgabeeinrichtung Öffnungen im Bürstenkopf in der Nähe der sich von diesem erstreckenden Borsten aufweist, die mit dem den medizinischen Wirkstoff enthaltenden Reservoir in Fluidverbindung stehen.

#### Revendications

1. Brosse à dents dotée d'une aptitude à distribuer du dentifrice, comprenant :

un ensemble de brosse à dents incluant un corps de brosse à dents (12), une tête de brosse (18) qui comprend des soies ou poils (56) à proximité d'une extrémité du corps, des moyens pour supporter la tête de brosse pour le mouvement vibratoire et des moyens pour entraîner (14) la tête de brosse de façon à la faire vibrer afin que l'ensemble de brosse à dents effectue un nettoyage mécanique des dents et produise également un effet de nettoyage acoustique pour les dents et les parties avoisinantes ; un réservoir à dentifrice (30) ; des moyens définis dans la tête de brosse (18) permettant la libération (43, 18, 87) du dentifrice à partir de la tête de brosse et des moyens (42, 44) raccordant ce réservoir (30) aux moyens de libération (43, 18, 87), la brosse à dents étant caractérisé en ce que le moyen d'entraînement (14) est situé dans le corps de brosse à dents (12) et comprend des moyens pour faire vibrer la tête de brosse à une fréquence et amplitude telle que le dentifrice est aspiré du réservoir et sort par le moyen de libération sous l'effet du mouvement vibratoire de la tête de brosse sans la nécessité de disposer d'une pompe située séparément.

2. Brosse à dents selon la revendication 1, caractérisée en ce que la fréquence de vibrations de la tête de brosse se situe dans la plage de 100-300 Hz.

3. Brosse à dents selon la revendication 1 ou 2, caractérisée en ce que la tête de brosse (18) comprend une petite chambre (43) qui est en communication de fluide avec les moyens de libération (43, 18, 87) et dans laquelle les moyens de raccordement comprennent des moyens raccordant le réservoir avec la petite chambre et la tête de brosse.

4. Brosse à dents selon l'une quelconque des revendications précédentes, caractérisée en ce que la tête de brosse est disposée de façon à être entraînée à une fréquence et amplitude suffisantes pour amener de l'énergie acoustique au dentifrice à l'intérieur de la tête de brosse, ce qui facilite la cavitation du dentifrice lorsque celui-ci sort des moyens de libération.

5. Brosse à dents selon la revendication 2, dans laquelle au moins certains des soies ou poils (56) sont creux et se trouvent en communication de fluide avec les moyens de raccordement et par conséquent le réservoir, les poils creux définissant ainsi les moyens de libération.

6. Brosse à dents selon la revendication 2, dans laquelle les moyens de libération comprennent des ouvertures en forme de tuyère (87) dans la tête de brosse, les poils ou soies (84) étant pleins et disposés par touffes et les ouvertures en forme de tuyère (87) étant en communication de fluide avec les moyens de raccordement et par conséquent avec le réservoir.

7. Brosse à dents selon la revendication 5, dans laquelle la source d'énergie acoustique (14, 16) est capable de faire vibrer la tête de brosse à une fréquence et amplitude telles que le fluide est libéré des soies ou poils au moins partiellement par action capillaire.

8. Brosse à dents selon la revendication 5, dans laquelle la taille des ouvertures creuses des soies ou poils et la source d'énergie acoustique (14, 16) permettent la vibration de la tête de brosse à une fréquence et amplitude telles que le fluide est libéré des soies ou poils au moins partiellement par la force centrifuge.

9. Brosse à dents selon la revendication 6, dans laquelle les soies sont positionnées sur la tête de brosse l'une par rapport à l'autre de telle sorte et la source d'énergie (14, 16) est capable de faire vibrer la tête de brosse à une fré-

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quence et amplitude telles que le fluide est libéré des ouvertures au moins partiellement par action capillaire.

- 5      **10.** Brosse à dents selon la revendication 6, dans laquelle la taille des ouvertures est telle et dans laquelle la source d'énergie acoustique (14, 16) est capable de faire vibrer la tête de brosse à une fréquence et amplitude telles que le fluide est déchargé des ouvertures au moins partiellement par la force centrifuge.
- 10      **11.** Brosse à dents selon la revendication 1, dans laquelle le fluide comprend un agent médicinal et dans laquelle l'amplitude et la fréquence des vibrations de la tête de brosse sont suffisantes pour produire une énergie acoustique à proximité de tête de brosse suffisante pour activer l'effet de l'agent médicinal au niveau des dents.
- 15      **12.** Brosse à dents selon la revendication 11, dans laquelle les soies ou poils ont une ouverture creuse les traversant longitudinalement, les soies ou poils creux étant en communication de fluide avec le réservoir contenant l'agent médicinal.
- 20      **13.** Appareil selon la revendication 11, dans lequel les moyens de libération comprennent des ouvertures dans la tête de brosse à proximité des soies ou poils qui s'étendent à partir de celles-ci, les ouvertures étant en communication de fluide avec le réservoir contenant l'agent médicinal.
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- 30
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- 40
- 45
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- 55

FIG. 1

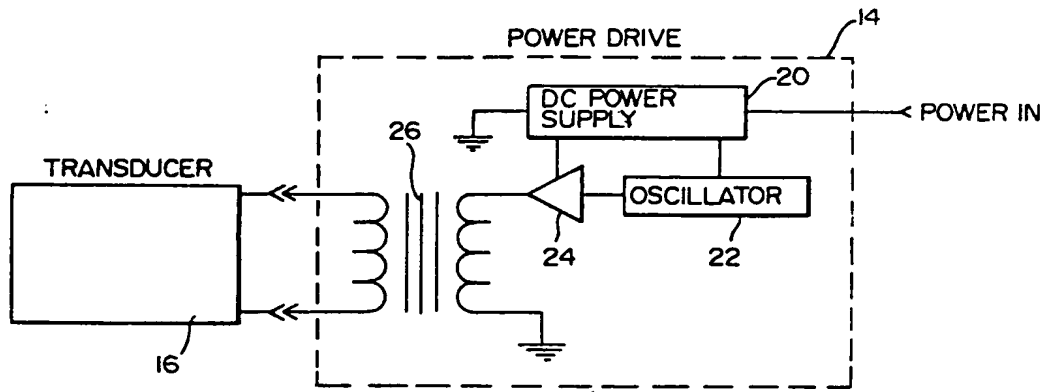
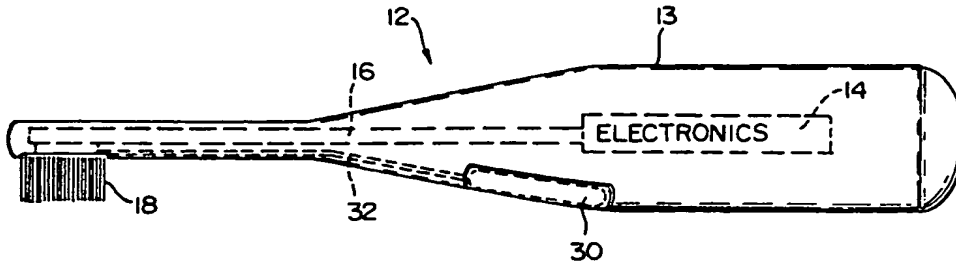


FIG. 2

FIG. 3

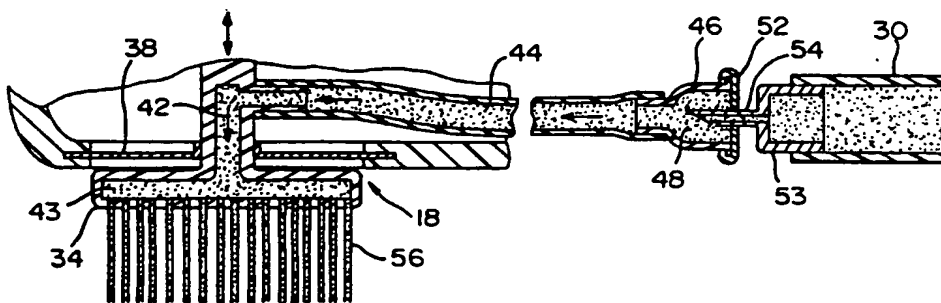


FIG. 4

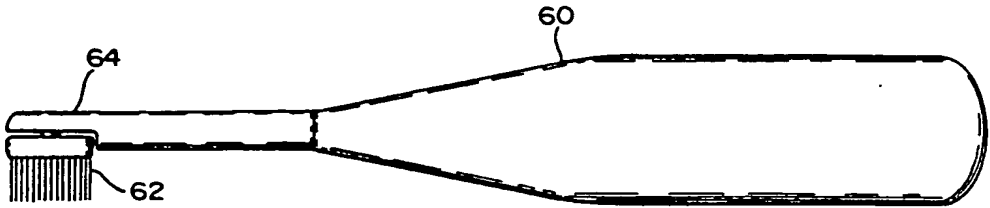


FIG. 5

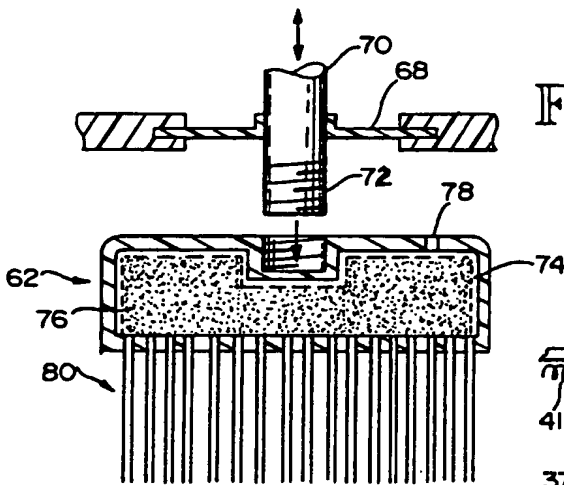


FIG. 7

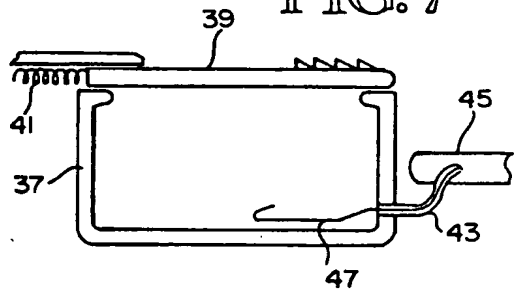


FIG. 8

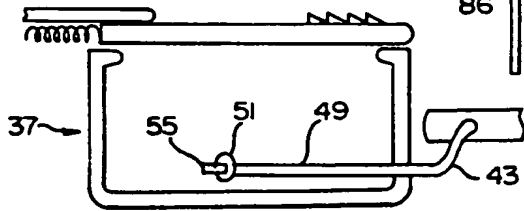


FIG. 6

